NATIONAL BUREAU OF STANDARDS REPORT

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FIRE ENDURANCE TEST OF BULKHEAD ASSEMBLY

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For

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U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

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ABSTRACT

A bulkhead assembly was subjected to a standard fire test to determine its suitability for approval by the U. S. Coast Guard for use on merchant vessels. The joint and mounting assembly has designed to allow for thermal expansion of the members. The unexposed surface temperatures remained within the specified limits for over 19 minutes and the specimen remained an effective barrier to flame passage for the full 60 minute test period.

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1. INTRODUCTION

At the request of the U. S. Coast Guard (letter of 26 September 1957), a bulkhead specimen was subjected to fire test in compliance with Subpart 164.006-3(b) of Specification for Bulkhead Panels for Merchant Vessels.

2. TEST SPECIMEN

The specimen was submitted by, and shipped from, the Nippon Asbestos Co., Ltd., Tokyo, Japan. It bore two labels which read: 1) Taibo No. 6400, Marine Board 60-F (test sample) and, 2) Taibo No. 6400, 4ft x 8ft x 7/8 in. (test sample). The specimen was received completely assembled and ready for placement in the furnace test frame. Therefore, the description is based primarily on examination after test. The bulkhead material was a hard white smooth-finished board that appeared to be a

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cement-asbestos material. No attempt was made to establish the composition further. The board was in two pieces, one 17 in. and the other 30 1/2 in. wide, both 7/8 in. thick. The thickness was determined along an edge protected by the mounting details. The thickness over most of the specimen had been reduced to as little as 5/8 in. as a result of the fire exposure. The two pieces of marine board were in a frame made up of four lengths of 0.072 in. thick sheet steel formed into 1 in. deep channel sections with the sheet bent back 1/2 in. inside each lip of the channel. The width between these turned back edges was such that the marine board fit between snugly. The two pieces of board were supported along the joint between them by a joint member made up of two T-section pieces bolted together into an H-section. The pieces were of 0.064 in. thick steel and were held together by five 1/4 in. bolts, at about 10 in. oc. The flanges of the H section (or tops of the individual T section pieces) were 2 5/16 in. across and the space between flanges was such that the marine board fit between snugly. The top and bottom ends of the H-section and vertical channel sections along the sides fit into the horizontal channel sections across top and bottom of the marine board. The vertical members were welded to the top channel but merely fit into the bottom one to a distance of about 1/2 in., thereby leaving about 7/16 in. allowance for thermal expansion of the vertical members. The bottom channel was welded to an assembly of 1/4 in. steel plates to form a part of the system for mounting the specimen in the test furnace. Details of the test specimen are shown in figure 1.

3. TEST METHOD

The specimen was mounted in the center opening of a three-opening test frame, each opening being about 8 ft 2 in. high by 4 ft 2 in. wide. Care was taken that the overall specimen was restrained against vertical movement or expansion, so that the only relief for thermal expansion would be that provided for by the design and fabrication of the specimen. Eight thermocouples were placed on the unexposed surface of the specimen, three on

the metal joint member and the other five distributed on the wider of the two marine board panels. A 6- x 6- x 0.4 in. felted asbestos pad was placed to cover the junction and several inches of the wires of each thermocouple. The furnace fires were controlled to produce temperatures as close as feasible to those defined by the standard time temperature curve of ASTM E-119, which include: 1000°F at 5 min, 1300°F at 10 min, 1550°F at 30 min, and 1700°F at 1 hr. The furnace temperatures were indicated by self-balancing potentiometers connected to thermocouples, which were encased in porcelain insulators and iron pipes, in the furnace chamber.

4. RESULTS

The fire test was conducted November 25, 1957. In addition to personnel of the NBS Fire Protection Section, the following were among those witnessing the test:

L. Colucciello, Lt., USCG, Washington, D. C.
S. Otsuka, Nippon Asbestos Co., Tokyo, Japan

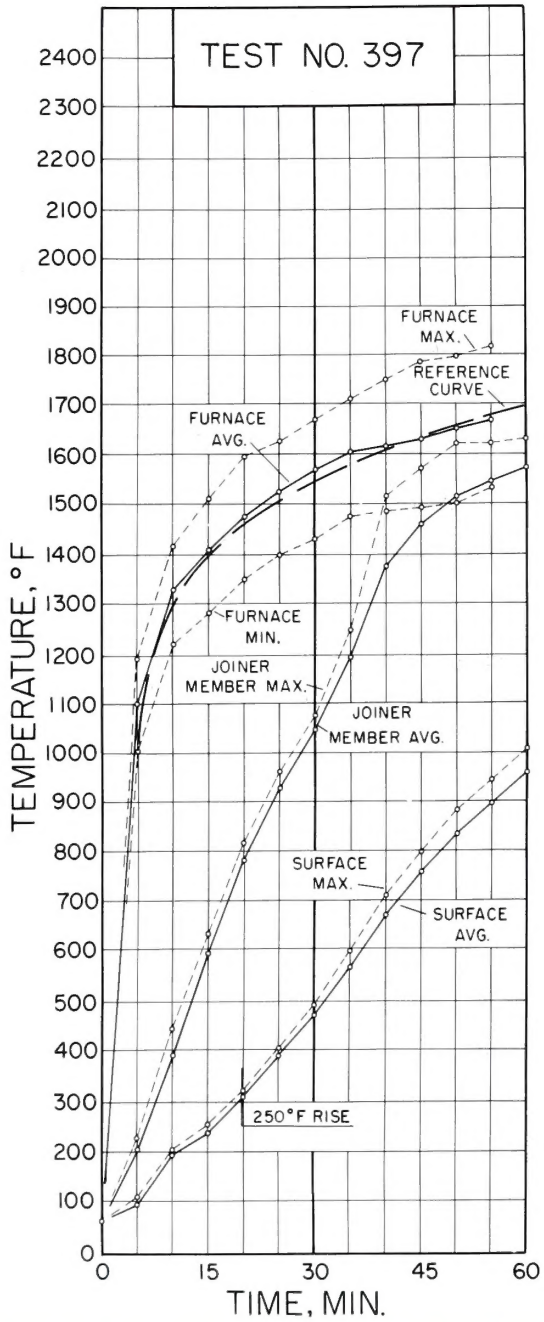
The paint on the exposed surface of the joint member was blistered in the first few minutes and that on the unexposed surface darkened by 13 min. By 32 min there was some slight buckling of the exposed surface joint member in the top 3 ft, and the center of the specimen had bowed 0.3 in. from the fire. By 39 min there was a noticeable bulge in the wider marine board panel, and the specimen center deflection had increased to 0.6 in. This deflection increased to about 0.9 in. by the end of the 60 min test period.

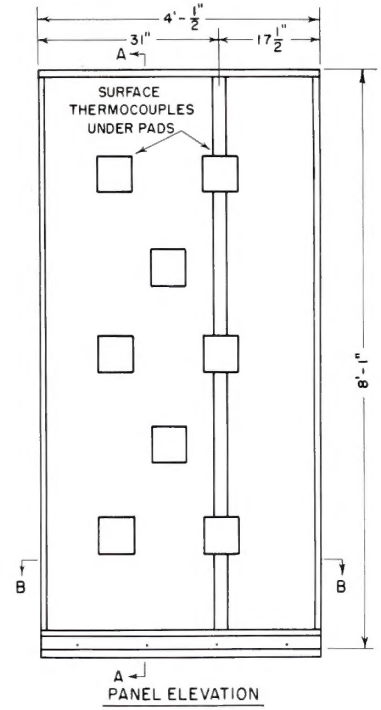
The fire exposure severity was 101.3 percent. Flames did not pass through the specimen at any time. The 250 degree F rise of the unexposed surface average temperature was reached at 19.9 min on the marine board and 7.9 min on the joint member; one-point rises of 325 degrees F at 23.9 min and 8.6 min on the marine board and joint member, respectively.

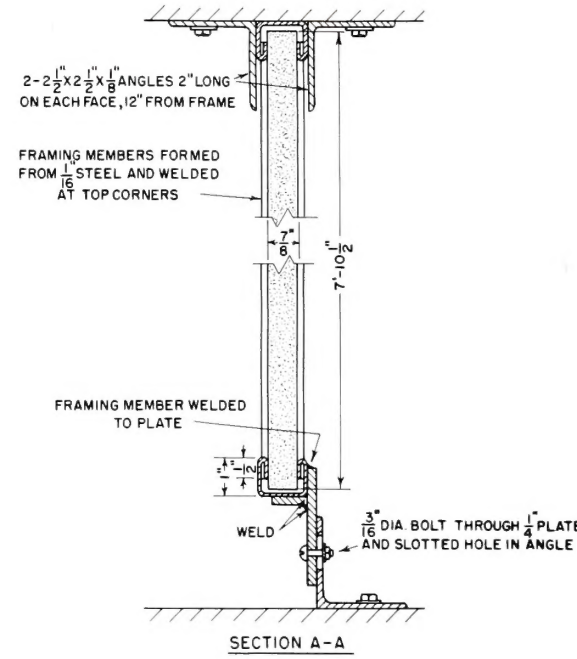
5. [illegible]

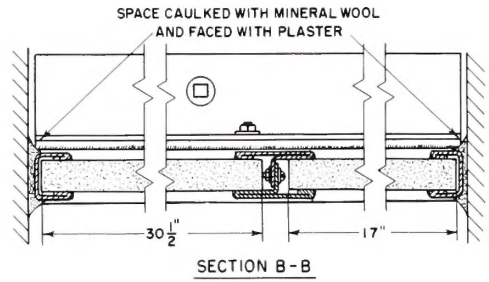
The results of the test indicate that the particle-
board panel had resistance to heat transmission
sufficient to keep the unexposed surface temperature within
the allowed limits for over 1½ hr. The combination of
particle board, joint sealer, and sagging glass, including
provisions for thermal expansion, was such that the
specimen remained an effective barrier to the passage of
flame throughout the 60 min test period.

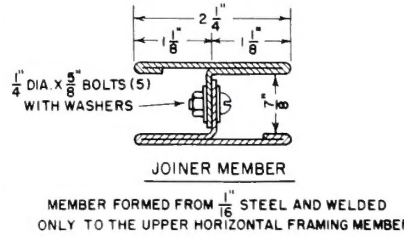
Figure 1. Construction details, thermocouple locations on unexposed surface, and time-temperature curves.











CONSTRUCTION DETAILS AND THERMOCOUPLE LOCATIONS